

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
3 October 2002 (03.10.2002)

PCT

(10) International Publication Number
WO 02/078409 A1

(51) International Patent Classification⁷: **H05K 1/18**

[SE/SE]; Sankta Ingrids väg 8, S-596 31 Skärnninge (SE).
ALBORNOZ DAVILA, Nivardo [SE/SE]; Branholmsgränd 64, S-127 46 Skärholmen (SE).

(21) International Application Number: **PCT/SE02/00582**

(74) Agent: **ERICSSON MICROELECTRONICS AB, DEPARTMENT FOR INTELLECTUAL PROPERTY RIGHTS**; Isafjordsgatan 16, S-164 81 Kista - Stockholm (SE).

(22) International Filing Date: 22 March 2002 (22.03.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0101006-5 22 March 2001 (22.03.2001) SE

(71) Applicant (*for all designated States except US*): **TELEFONAKTIEBOLAGET LM ERICSSON (publ)** [SE/SE]; Telefonvägen 30, S-126 25 Stockholm (SE).

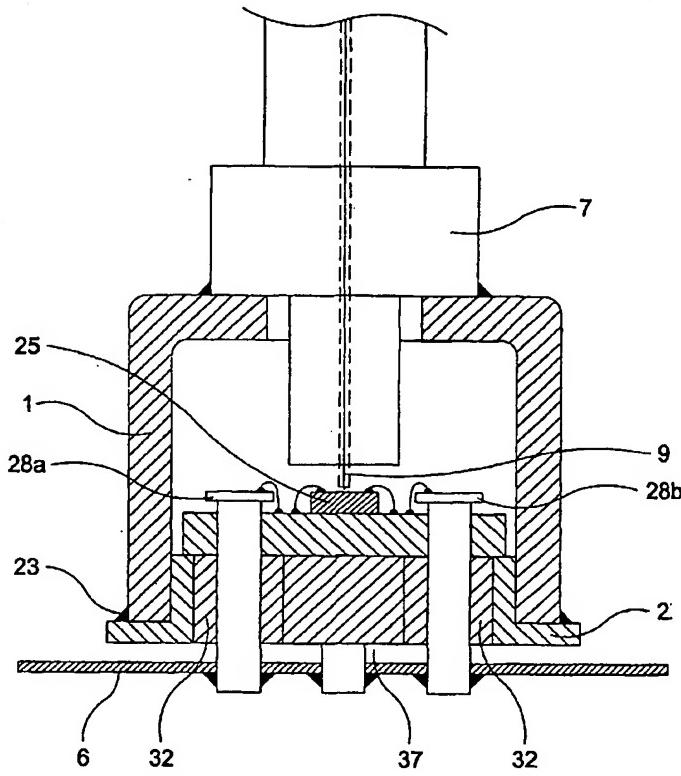
(72) Inventors; and
(75) Inventors/Applicants (*for US only*): **BLOM, Claes**

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),

[Continued on next page]

(54) Title: A TO-CAN HAVING A LEADFRAME



WO 02/078409 A1

(57) Abstract: The present invention relates to a TO-can type encapsulating element for enclosing, either hermetically or non-hermetically, optical-electrical chips with integrated optical element interfaces, detachable fibres and leadframes. The TO-can/encapsulating element enables the optical fibre (9) to be readily positioned relative to the chip (25) with the aid of a fixable can-flange (7), and eliminates the risk of crack formation by virtue of the component leads of said TO-can having been provided with and connected to a leadframe (6).



Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

A TO-CAN HAVING A LEADFRAME

5

The present invention relates to a can for the hermetic or non-hermetic enclosure of an optical-electric chip that includes an integrated optical element interface, a detachable fibre pigtail and a leadframe.

10

DESCRIPTION OF THE BACKGROUND ART

The technique of encapsulating optical-electric chip in so-called TO-cans (TO/Transistor Outline) provides obvious advantages with respect to maintaining stable positioning of, for instance, an optical fibre relative to an optical-electric chip in environments of changing temperatures. In present day technology, lenses are often used to maintain an acceptable coupling between fibres and chip, which renders the cost involved unacceptable in the case of certain applications. TO-cans/encapsulations may include a receptacle that can be detached from the can, although this optical element interface has often been produced in an unnecessarily expensive manner with regard to the choice of material and design. When TO-cans have been mounted on a printed circuit board, their component leads have normally been bent down towards the board, which may have a negative affect on the transmission properties at high frequencies in some contexts. There is also a risk of the formation of microcracks in the glass transit that embrace the component leads in the mounting base of the TO-can. Little account is often paid to the fact that transmission at high frequencies can be improved when the transmission conductor has conductors with 0-potential on two sides.

SUMMARY OF THE INVENTION

30

The structural design outlined in Figure 1 includes a component that has several significant properties. Positioning of an optical fibre in relation to an optical-electric chip can be achieved relatively simply, by moving a ferrule in two dimensions until coupling of the

light is satisfactory (see Figure 2). The ferrule can then be fixed by laser welding, gluing or soldering processes.

The so-called TO-can shown in Figure 1 also includes a ferrule interface which enables

- 5 two ferrules with optical fibres to be coupled in relation to each other in a guide sleeve. The optical interfaces of the fibre ends are brought into contact with each other with the aid of a locking sleeve that includes a bayonet fitting, which subsequent to being pressed and rotated ensures that a spring pressure can be maintained for mutual contact of said ends during operation.

10

- To eliminate the risk of the formation of microcracks among other things, the component leads of the TO-can have been provided with a leadframe, the construction of which can be seen from Figure 3. The leadframe with its short lead-ins together with the positioning of the earth leads of the mounting base on both sides of the transmission conductor ensures
15 that the transmission properties will be good and that stable positioning between a fibre and an optical-electric chip can be maintained.

- The leadframe can be soldered to the mounting base leads or fastened thereto in some other way, to create a low-resistance connection. The leadframe can be further supported against
20 the mounting base with a glue joint, an injection moulded joint or a compression moulded joint. At this stage, all leads are short-circuited to a common potential, which is beneficial from an electric discharge aspect (ESD).

- As will be evident from the markings in Figure 3, the leadframe can then be split up
25 (clipped) to separate the individual leads and to adapt said leads for mounting on the printed circuit board. With the intention of achieving component stability when mounting the component on the printed circuit board, a combined support leg and mounting leg have been placed on the end wall of the can, as will be seen from Figure 1. The entire component or parts thereof may be enclosed in a thermoplastic or thermosetting material.

30

The invention will now be described in more detail with reference to a preferred embodiment thereof and also with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a partially exploded outline view of the various structural elements for effecting an optical-fibre connection to a TO-can.

- 5 Figure 2 is a cross-sectional view of a TO-can arranged in accordance with the invention and mounted in the absence of a leadframe.

Figure 3 shows a leadframe mounted on the leads of the TO-can.

Figure 4 is a cross-sectional view of the TO-can arranged in accordance with the invention and mounted with a leadframe.

10

DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 is a partially exploded perspective view of the various structural elements for connecting an optical fibre to a TO-can, where the can 1 includes a mounting base 2, a

- 15 leadframe 6 and an end wall 3. The end wall 3 has a hook 4 and a hook leg 5. A capsule ferrule 8 having a capsule flange 7 is shown fitted to the end wall 3, with an optical fibre 9 disposed in a cylindrical cavity, where said optical fibre 9 is glued firmly inside the ferrule 8 or fastened thereto in some other way. An optical fibre 20 is shown partially bared and fitted in a ferrule 11 with its flange 12 and its guide 14. The guide 14 is surrounded by a coil spring 13. The capsule ferrule 8 with its optical fibre 9 is guided in relation to the ferrule 11 with its optical fibre 20 by means of a guide sleeve 10 which has been made resilient by slitting the sleeve or in some other way. A locking sleeve 15 runs on the optical fibre 20. The locking sleeve 15 has at least two locking recesses 16a and 16b, an end surface 17 and a guide hole 18. To prevent the fibre being broken, the locking sleeve 15 includes an integrated anti-break element 19 formed integrally with the locking sleeve 15.

The structural elements illustrated in Figure 1 are assembled by pressing one end of the guide sleeve 10 onto the ferrule 8, wherewith the guide sleeve 10 yields slightly and therewith embrace the ferrule 8. The ferrule 11 is pressed into the other end of the guide sleeve

- 30 10, so as to be enclosed therein. The locking sleeve 15 with its locking recesses 16a and 16b is moved towards the hook 4 and the hook leg 5, so that the hook 4 and the hook leg 5 can be guided into the locking recesses 16a and 16b and the guide 14 can enter the hole 18, wherewith the coil spring is brought into contact with the end surface 17. The locking sleeve 15 is pressed further towards the mounting base 2, so as to compress the coil spring

- 13 between the flange 12 and the end surface 17, therewith bringing the optical fibre 9 in the ferrule 8 into contact with the optical fibre 20 in the ferrule 9, wherewith an optical contact element can be releasably attached to the capsule with the aid of the mutually opposing ferrule interfaces. A fibre pigtail can be releasably mounted on the component, by 5 clockwise rotation of the locking sleeve 15 until the hook 4 and the hook leg 5 reach the end position of respective locking recesses 16a, 16b.

Figure 2 is a detailed cross-sectional view of the various structural elements of a TO-can according to the invention, where the cylindrical can 1 is fastened to the cylindrical 10 mounting base 2 with the aid of a can joint 23. At least one ground lead G is fastened to the mounting base 2 with the aid of a lead joint 31, such that the ground lead is able to function as a cooling sink and as an electrical 0-potential from the mounting base 2 down towards a printed circuit board for instance. The mounting base also includes at least one transmission lead T and one current supply lead Vcc each having lead ledges 28a and 28b. The 15 leads are surrounded by electrically insulated transits or leadthroughs 32 at the places where the transmission lead T and the current supply lead Vcc penetrate the mounting base 2. One or more carriers 27 are glued or soldered firmly to the upper side of the mounting base 2, and one or more optical-electrical chips 25 are glued or soldered firmly to the upper 20 surface of said carrier. Subsequent to being optimised, the cylindrical ferrule 8 with its fixable flange 7 and its cylindrical ferrule-part 33 are secured to the upper side of the can 1 with a so-called ferrule joint 22 by means of a laser welding, soldering or gluing process. An optical fibre 36 is secured within the ferrule 8, by means of a clamping action, a gluing 25 process or a soldering process. The optical fibre 36 has an outwardly protecting part 9 which is adapted so that the ferrule-part 33 will not come into contact with a bonding wire 26 or other wires. Because the can includes means for positioning a connected optical fibre to the optical-electrical component without the use of lens elements, and because the ferrule 8 is moved in an x-direction and a y-direction over the can 1 in its cylindrical recess 24, optimisation can be achieved with respect to light incoming from the optical fibre 36 to the optical-electrical chip 25 with its optically active area 21 or, when the optical-electrical chip 25 is a light emitting component, the chip 25 can transmit light from the 30 optical area 21 to the optical fibre 36 in an optimised manner.

Figure 3 is a view taken from beneath the mounting base 2 and shows the ground lead G, the transmission lead T and the power supply lead Vcc of said base, said leads having been

connected to a leadframe 6. The leadframe 6 is configured so that the ground lead G extends on both sides of the transmission lead T, therewith contributing towards limiting the distortion at high bit rates and, at the same time, functioning as symmetrical cooling sinks between the mounting base 2 and a printed circuit board 35 together with its metal conductors. The leadframe 6 is mounted with the leads in joins 37, which have been produced by crimping, laser welding or soldering, or by some other appropriate joining method, whereafter the leadframe 6 has been divided at cutting locations 34, so as to separate the various leads in the leadframe. The lead separated in the leadframe are length matched/impedance matched to obtain optimal transmission properties.

10

Figure 4 is a detailed cross-sectional view illustrating the various structural elements in the TO-can, and shows the cylindrical can 1 secured to the cylindrical mounting base 2 by can joints 23, and the leadframe 6 connected to the leads T, G and Vcc. The ground lead G is fastened to the mounting socket with the aid of lead joints in a manner to enable the ground lead to function as a cooling sink and an electric 0-potential from the mounting base down to a printed circuit board for instance. The mounting base includes at least one transmission lead T and one power supply lead Vcc, each having a respective lead ledge 28a and 28b. The leads are surrounded by said electrically insulated transits or leadthroughs 32 at the place where the transmission lead T and the power supply lead Vcc penetrate the mounting base 2. The leadframe 6 is configured so that the ground leads G will extend on respective sides of the transmission lead T. The leadframe 6 is fastened with the leads in joins 37, which have been made by crimping, laser welding or soldering or in some other suitable way, whereafter the leadframe 6 has been divided at the cutting locations 34 so as to provide mutually separate and length-matched conductors to the various leads, which are then cut slightly beyond the joins 37.

It will be understood that the invention is not restricted to the aforescribed and illustrated exemplifying embodiments thereof and that modifications can be made within the scope of the accompanying claims.

CLAIMS

1. A TO-can type encapsulation for enclosing optical-electrical chips that include an integrated optical-element interface, detachable fibre pigtail and leadframe, **characterised in** that the leads of the can are connected to the leadframe (6).
- 5
2. A capsule according to Claim 1, **characterised in** that the leads of the leadframe (6) are length adapted/impedance matched for optimal transmission properties.
- 10
3. A capsule according to Claim 1, **characterised in** that the capsule includes means (7,22) for positioning a connected optical fibre (9) in relation to an optical-electrical component (25).
- 15
4. A capsule according to Claim 1, **characterised by** an optical contact element that can be attached to and released from the capsule with the aid of mutually opposing ferrule interfaces (8,11).

1/4

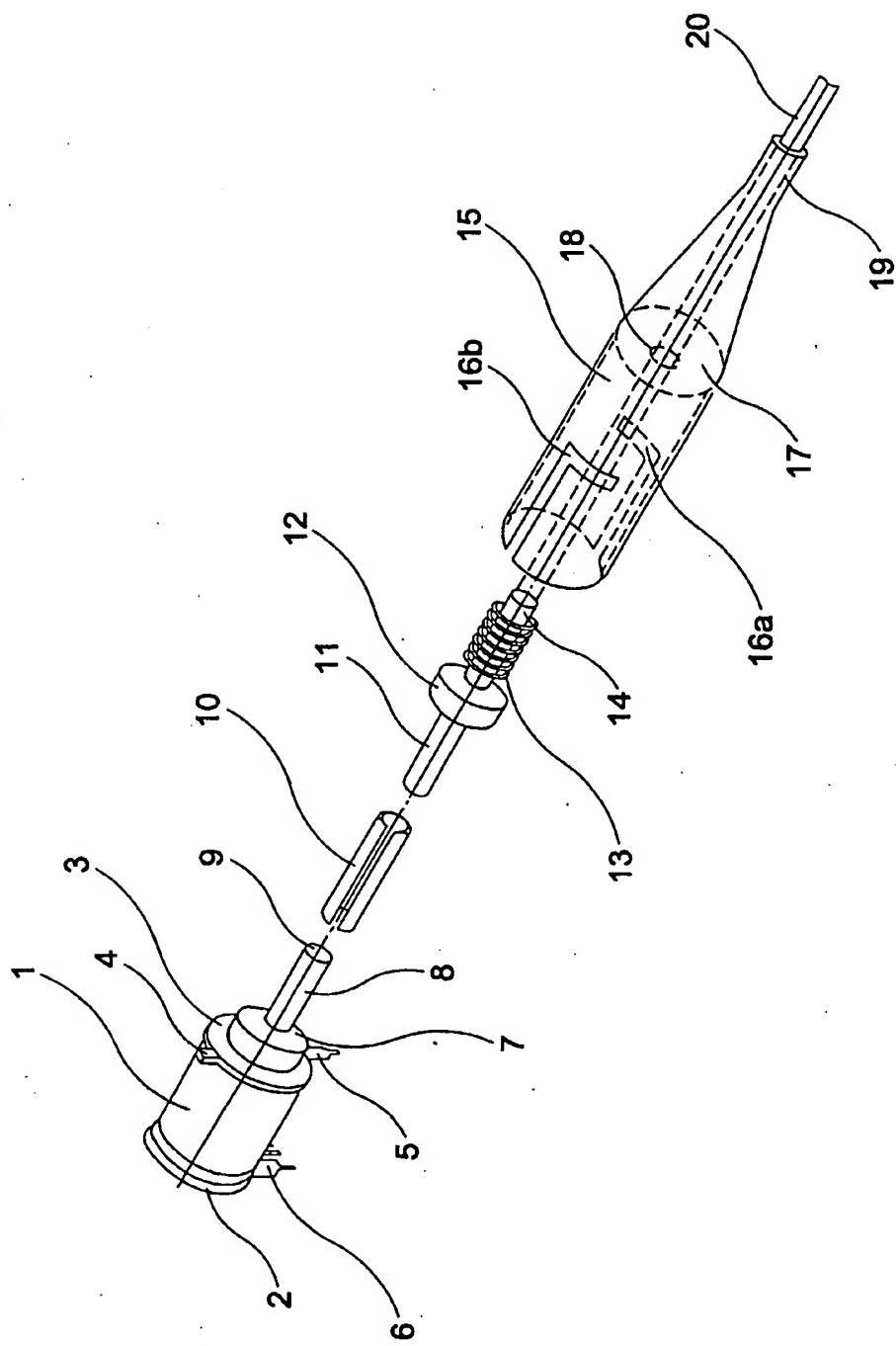


Fig. 1

2/4

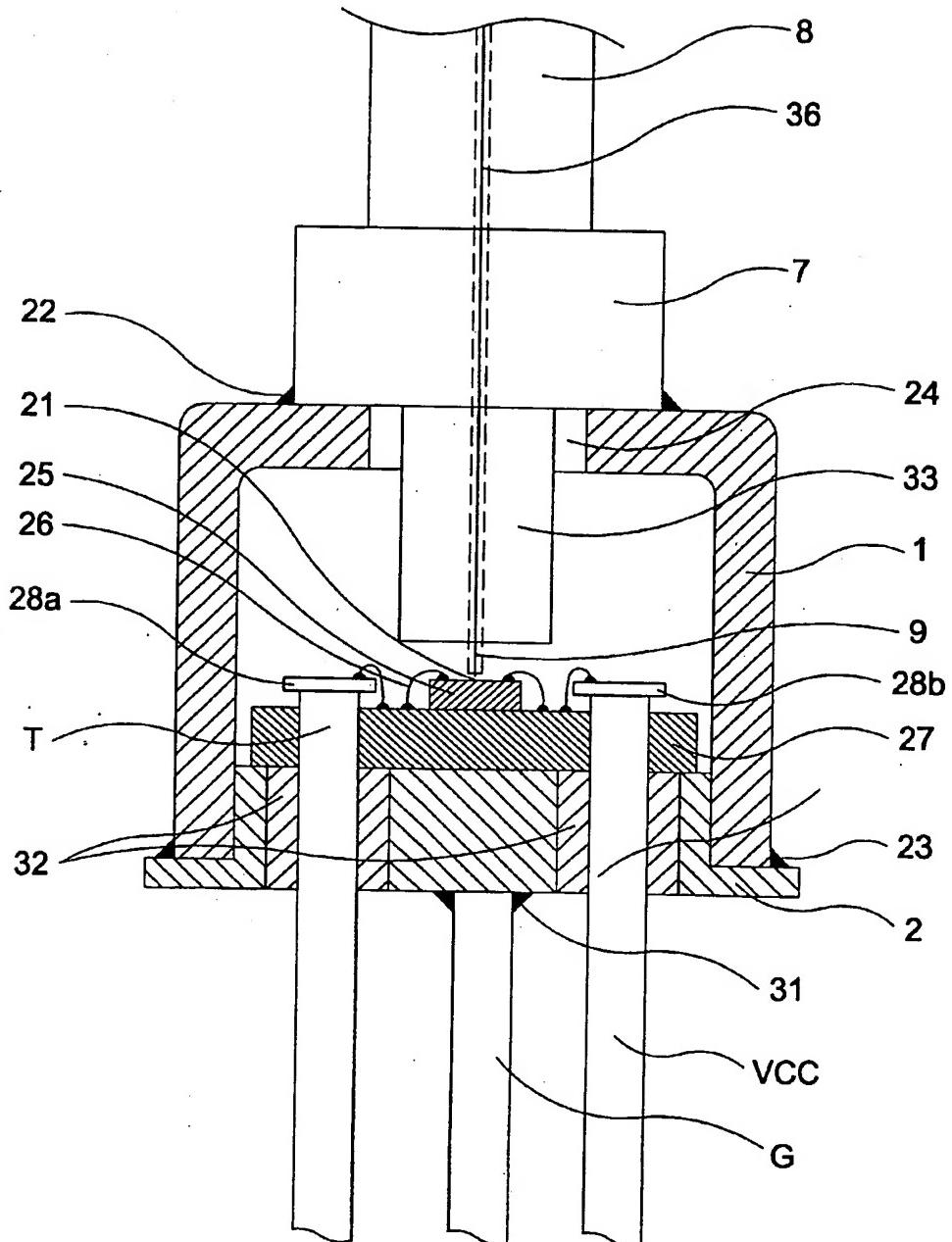


Fig. 2

3/4

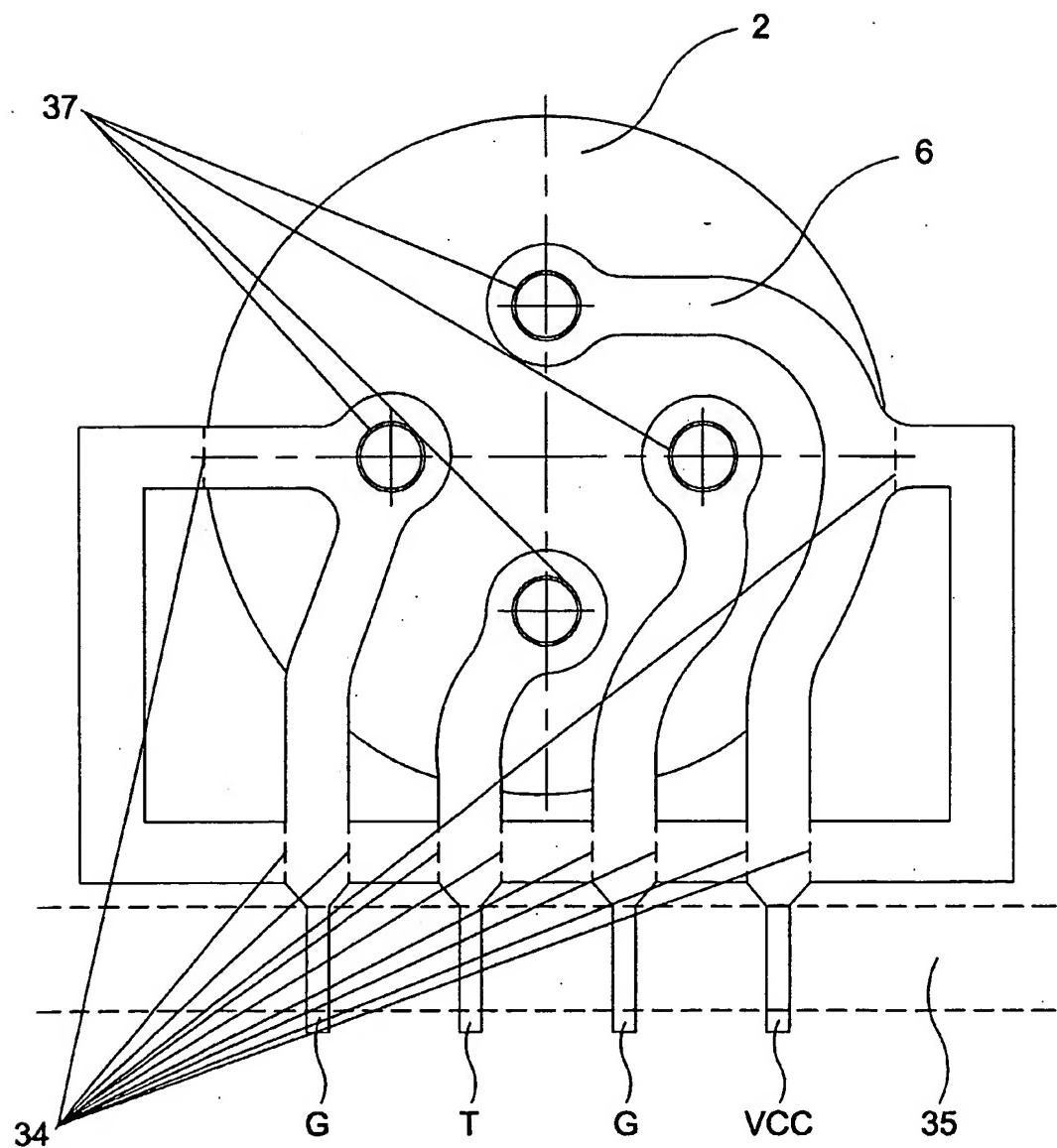


Fig. 3

4/4

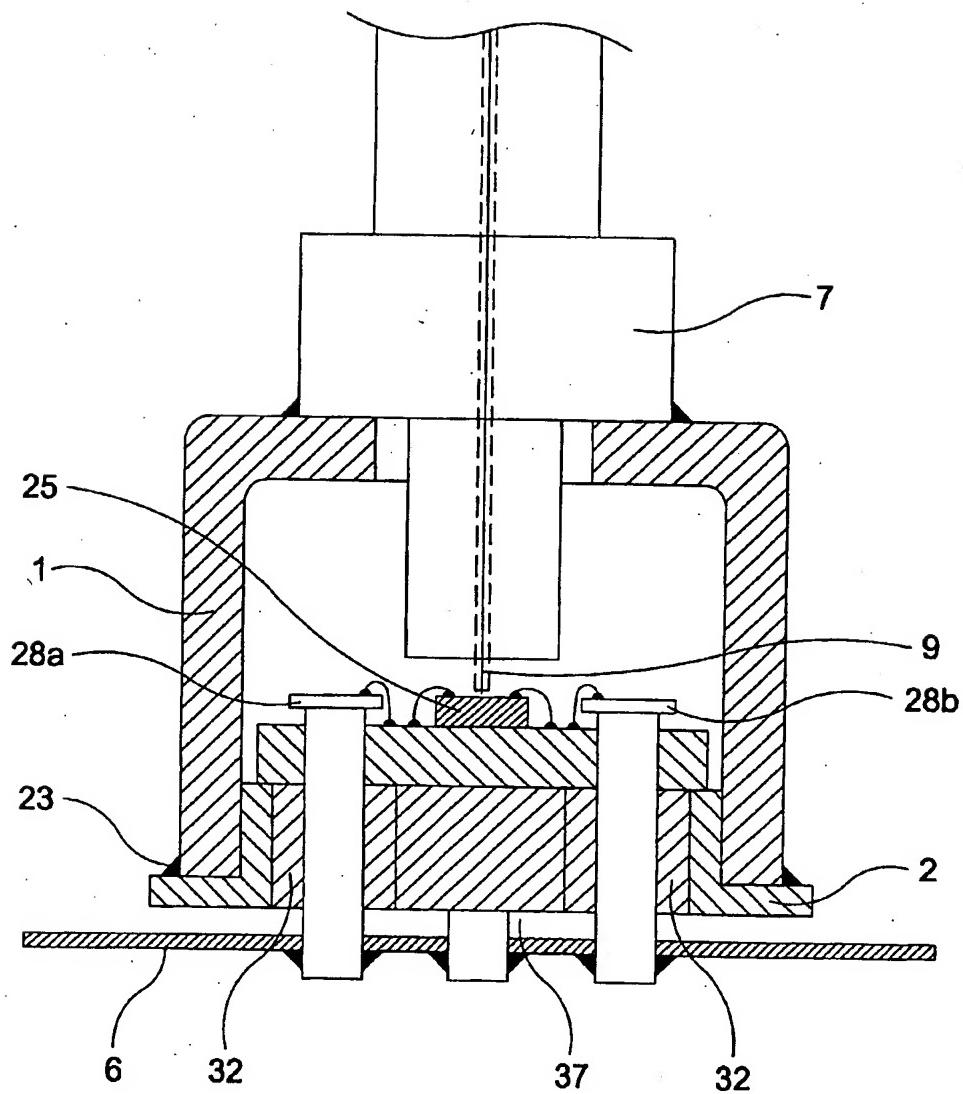


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 02/00582

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H05K 1/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 6164099 A (MITSUBISHI ELECTRIC CORP) 1994-04-30 (abstract). (online) (retrieved on 2001-10-23) Retrieved from: EPO PAJ Database --	1-4
A	JP 7283072 A (DAISHINKU CO) 1996-02-29 (abstract). (online) (retrieved on 2001-10-23) Retrieved from: EPO PAJ Database -----	1

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

10 July 2002

19 -07- 2002

Name and mailing address of the ISA/
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. + 46 8 666 02 86Authorized officer

Magnus Westöö/mj
Telephone No. + 46 8 782 25 00

THIS PAGE BLANK (USPTO)